
CHAPTER 15

SURVEY PLANNING

The purpose of artillery survey is to provide firing and target-locating assets with a common grid. Common survey control allows the commander to tactically employ his units with a guarantee of accurate and timely fire support. This allows him to mass fires of subordinate units, to store and transfer target locations for future attacks, and to limit vulnerability of firing units. Planning for artillery surveys is based primarily on the planned positioning of firing units and TA assets and the commander's accuracy requirements.

15-1. CONDUCT OF PLANNING

a. Surveys are planned to ensure that all required control is provided in the correct place and at the time required. The plan distributes work evenly among teams and eliminates duplicate work. Planning is based on meeting as many survey requirements as possible under the given conditions and always providing the best available survey control to using units. Direction is the most important element of survey control. Therefore, when time is critical, the plan must reflect the requirement to rapidly extend direction throughout the area of operation and later extend coordinates and height.

b. Survey planning is conducted at all echelons at the same time. Provisions should be made to link together all surveys conducted in the area. Normally, the surveyors of div arty HHB provide survey control points to all assigned and attached battalions or separate batteries. Thus, they tie together the surveys of the division firing and locating elements. The TAB and battalion surveyors survey their organic and attached elements and help other units as directed. The degree of accuracy, speed of execution, and priority of work are given in the commander's guidance or are set by the S3 from the commander's guidance.

c. Artillery units at all levels start survey operations before occupation of position. They do not wait for higher-echelon survey control to be established in the area. Firing and target-locating units must work from the best available data and improve the data as higher-order survey becomes available.

d. Fourth-order survey sections are organic to the div arty HHB and TAB to provide survey control for assigned and attached units of the division. Each artillery battalion has an organic fifth-order survey section. These sections are organized into survey teams and equipped according to the modification tables of organization and equipment (MTOE) for the unit. The concept of employment of these sections is based on the guidelines below.

(1) *Div arty.* Provide all organic, attached, and reinforcing artillery battalions, TA assets, and separate batteries with common direction, coordinates, and height.

(2) *TAB.* Provide common direction, coordinates, and height for the TA assets of the battery. Provide SCPs for other units as directed by the TAB commander.

(3) *Battalion.* Provide common direction coordinates, and height for all firing batteries and targeting devices that are assigned or attached to or reinforcing the battalion and mortars.

e. For the purpose of planning a survey, installations may be separated into groups according to the accuracy of survey required. Requirements and position considerations are shown in Table 15-1.

(1) *Fourth order.* Fourth-order survey control is required at firing battalion and separate battery SCPs.

Table 15-1. Survey installations

TYPE OF SURVEY	INSTALLATION	REQUIREMENT	REMARKS
Fourth-order (PADS must use 5-minute Z-VEL corrections.)	Battalion SCP	Azimuth, coordinates, and height	Bn SCP within 2 km of center of battalion position area
	Battery SCP	Azimuth, coordinates, and height (azimuth not required for MLRS)	SCP within 2 km of center of battery position area
Fifth-order (PADS must use 10-minute Z-VEL corrections.)	Cannon battery (non-Paladin)	Azimuth from OS to EOL. Coordinates and height of battery center or OS	Orienting line part of main scheme if traverse is used
	Paladin howitzer	Coordinates and height to platoon area SCPs. Azimuth from SCP to an azimuth mark	Howitzer update points needed every 16 miles
	Patriot missile system	Orientation azimuth for radar, NREF. Coordinates and height of radar and launchers. Orientation azimuth for launchers	Perform two-position plumb bob or theodolite marks by using 10-minute Z-VEL or fifth-order conventional survey
	OH-58D (AHIP)	Coordinates and height of initialization and update points	Requires update every 15 minutes or 15 nautical miles
	MLRS	Coordinates and height of platoon area SCP	Update points needed every 6 to 8 km
	AN/TPQ-37 radar	Azimuth and distance from OS to azimuth mark Coordinates and height of radar position	Azimuth accuracy ± 0.4 mil (PE)
	AN/TPQ-36 radar	Azimuth, distance, and vertical angle from OS to azimuth mark Coordinates and height of radar position	Azimuth accuracy ± 0.4 mil (PE)
	Ground-based signal intercept radio direction-finding systems—Trail Blazer and Teammates	Coordinates and elevation for OS and EOL with azimuth	PADS uses 10 Z-VEL or fifth-order conventional survey

(2) *Fire order.* Fifth-order survey control is required by firing and target-locating installations. Some installations require 0.4-mil or 0.5-mil accuracy for direction. Care must be used in selecting a method to establish direction for these installations. The requirements for CEWI sites should be addressed by local SOP or coordinated by the div arty survey officer.

(3) *Hasty survey.* All firing and target-locating elements requiring survey must be able to use hasty survey techniques to provide the best available survey control rapidly. The hasty survey techniques preferred for a particular system are covered in the applicable field manual. For example, FM 6-50 prescribes hasty survey techniques for FA cannon batteries.

15-2. SURVEY PLANNERS

Survey planning is performed by many individuals at many levels. Some of these planners are discussed below.

a. Artillery commander or FSCOORD. The maneuver commander initiates the requirement for survey planning when he issues guidance to the FSCOORD. He does so by stating his scheme of maneuver, rate of movement, anticipated enemy threat, and critics) phases of the battle. The FSCOORD analyzes the commander's guidance to determine the need for passing of target information, first-round fire-for-effect accuracy, and massing of fires. He weighs his analysis against the ability to adjust fires, fire registration missions, and rapidly engage targets from new position areas. The concept for a survey plan to provide common survey control is thus begun.

(1) The FSCOORD then must extract from the maneuver commander's guidance information that will allow him to visualize the survey requirements for fire support (FS) assets. The FSCOORD can gain most of the information by reviewing the scheme of maneuver, rate of movement, effects required on high-payoff targets, and accuracy requirements for TA sensors. He must also determine whether it is more important to have survey at the guns or TA assets first.

(2) Each artillery commander is responsible for establishing common control throughout his area of operations. The FSCOORD must disseminate to the appropriate artillery battalion HQ the established accuracy requirements in survey terms. Additional requirements or guidance derived by the FSCOORD must also be **communicated**. This should either be done through face-to-face coordination or through the S3. The survey officer must be included in this coordination. He should advise the FSCOORD and/or S3 on his current survey capabilities and limitations. Figure 15-1 is a checklist for use by the FSCOORD as an aid in determining survey

requirements. This checklist is not inclusive and should be modified to meet situations) requirements.

b. Corps Artillery SPCO. The responsibilities of the SPCO associated with the corps survey effort are discussed below.

Figure 15-1. FSCOORD checklist

1. **Select primary, alternate, and supplementary position areas for the following:**
 - **Weapons:**
 - **FA battalions.**
 - Missiles.
 - Rockets.
 - Mortars.
 - **TA systems:**
 - Radars.
 - CEWI.
 - Observers.
2. **Select times as follows:**
 - Time survey to be completed.
 - Time to start fieldwork.
 - Time to start reconnaissance.
 - Time to start planning.
3. **Determine accuracies (hasty survey or fifth-order survey) for the following:**
 - FA battalions.
 - Observers.
 - Target locators.
4. **Determine the priorities for the weapons and TA systems of each of the following:**
 - DS battalion.
 - Reinforcing (R) battalion.
 - GS battalion.
 - GSR battalion.
 - Mortars.

TA systems include the following:

 - **Radars:**
 - AN/TPQ-36.
 - AN/TPQ-37.
 - **Observers:**
 - COLTs.
 - OPs.
 - **Other:**
 - CEWI.
 - Elevated target acquisition systems (ETASs).
5. **Coordinates as follows:**
 - To determine locations of the third-, fourth-, and fifth-order SCPs.
 - To determine when SCPs will be established.
 - To determine additional survey requirements from higher echelons.
 - To establish liaison with higher, lower, and adjacent units.

(1) Know the survey requirements of all corps units (Figure 15-2) and the survey capability of those units.

(2) Coordinate with the corps G2 to get intelligence estimates of the proposed work areas to include the following:

- Ž Enemy activity.
- Ž Friendly forces.
- Ž Other optional constraints.

(3) Coordinate with the corps G3 plans to get the following:

- Ž Current and planned positions of corps artillery units.
- Ž Unit movement plans.
- Ž Dates and times of movement.
- Ž Priority of unit movement.

This information used in planning and coordinating includes IEW systems requiring survey in support of corps missions. (Refer to Figures 15-3 and 15-4 for corps survey plan—in progress and future surveys overlay.)

(4) Make contact with the survey company of the engineer topo battalion and obtain necessary details from the commander (for example, attached platoon, location of company SPCE, and names of points of contact). The engineer topo battalions' survey company supports the field artillery and sir defense artillery with third-order horizontal and vertical control points and azimuth marks for EAC down to division and separate artillery brigades on a 24-hour basis. Topo survey augments FA survey requirements with the following:

- Ž EAC—two SCPs per Patriot battalion.
- Ž Corps area-eight SCPs each 24-hour period and one SCP per div arty or separate brigade each 24-hour period.
- Ž PADS—starting and closing SCPs are provided at a maximum interval of 25 km.
- Ž MLRS—starting and closing SCPs are provided at a maximum interval of 30 km.

Figure 15-2. Units requiring survey within a corps

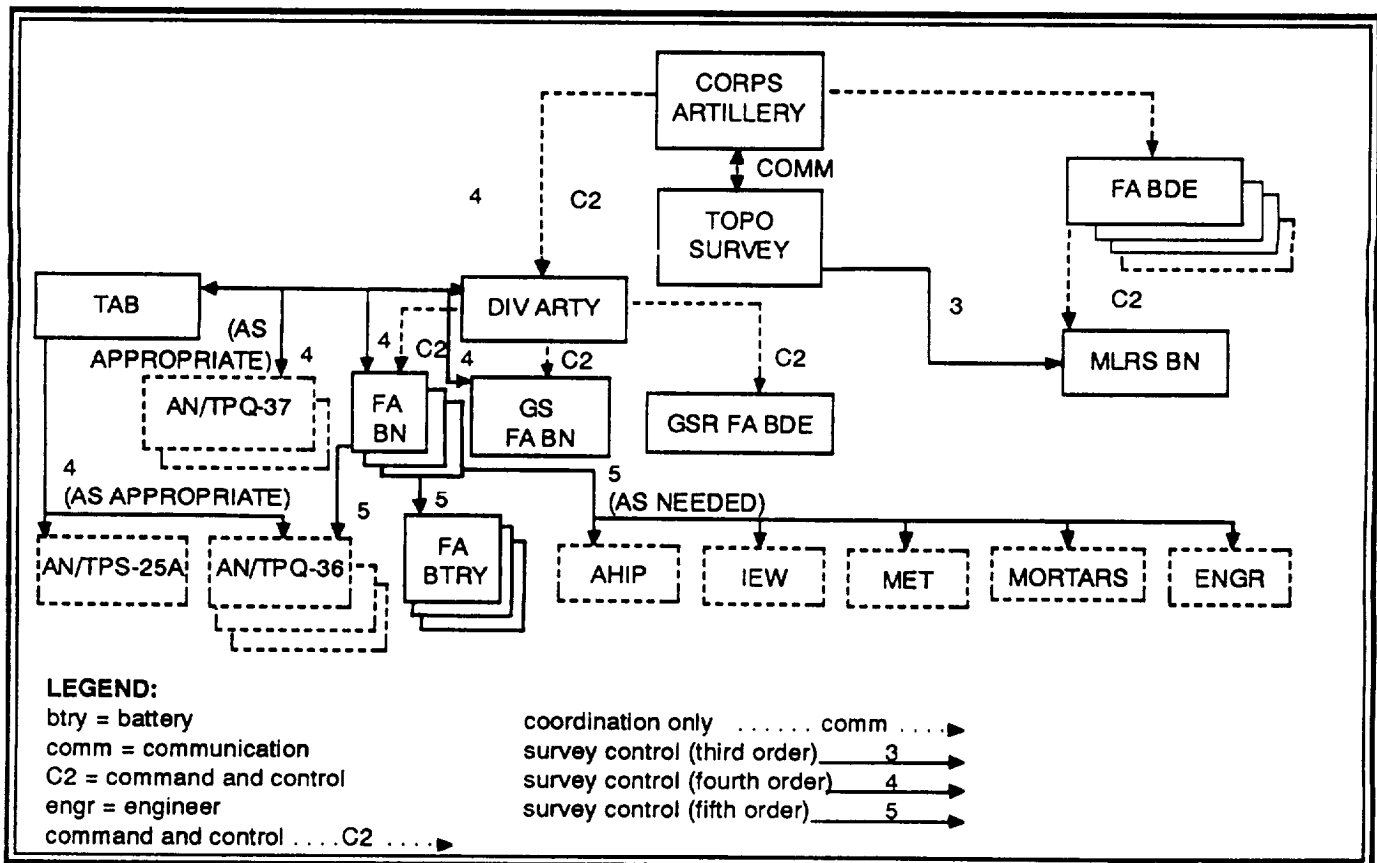


Figure 15-3. Corps survey plan—in progress

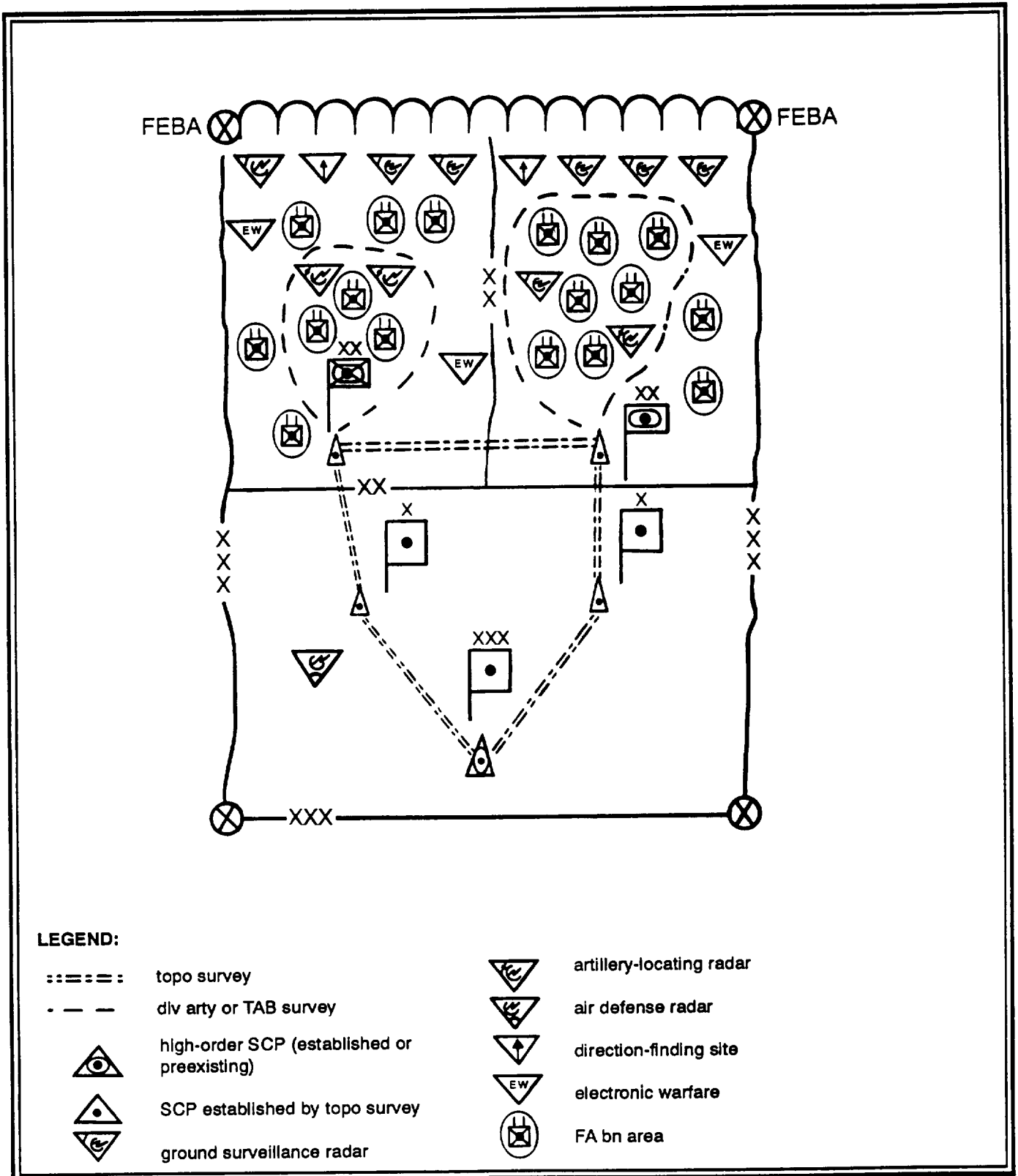
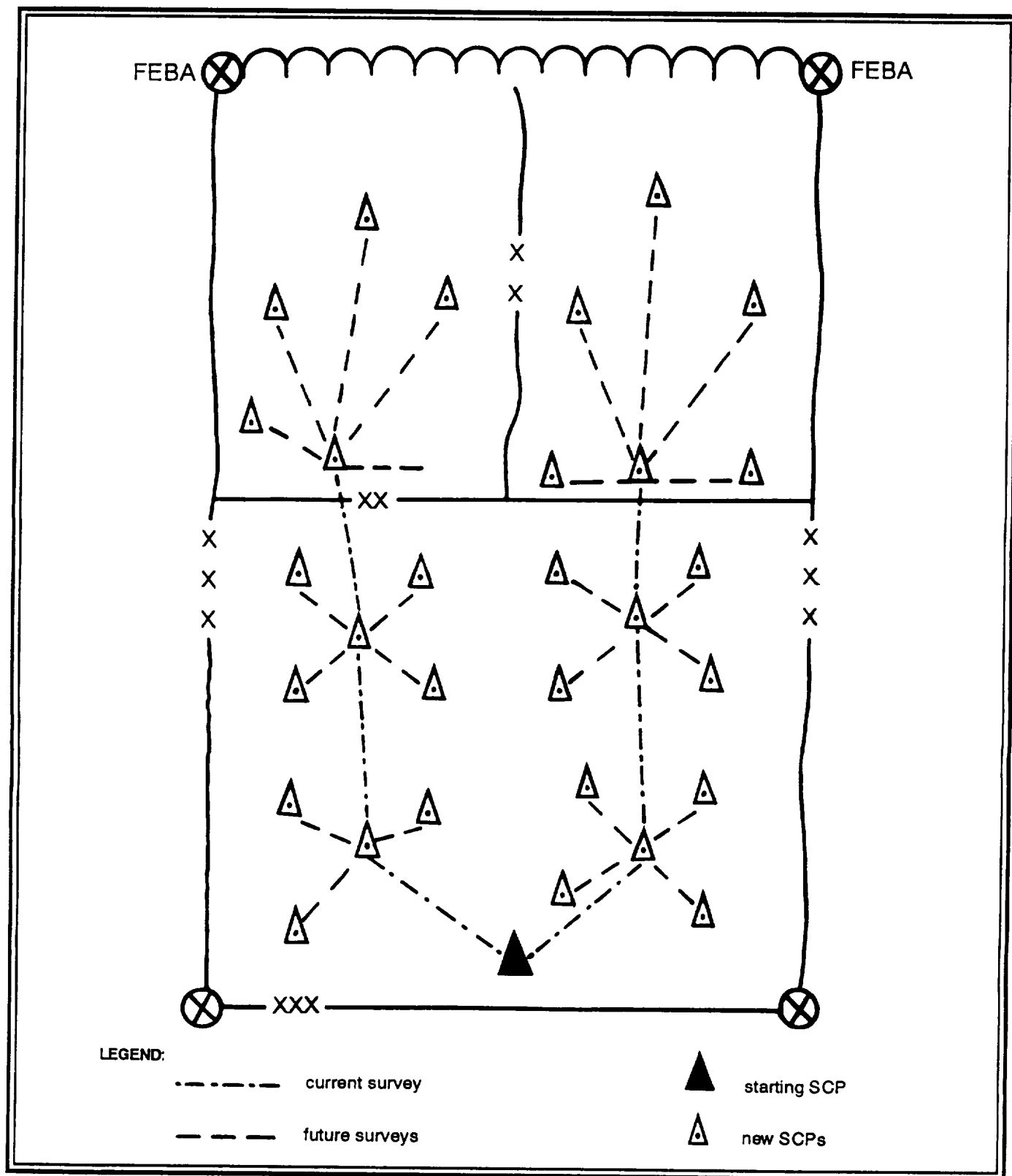


Figure 15-4. Corps survey plan—future surveys overlay



(5) Make necessary arrangements with headquarters and headquarters company (HHC), corps for administrative and logistical support of the topo survey platoon.

(6) Arrange and coordinate with the corps aviation company for aviation support if requested by the survey platoon leader of the engineer topo survey company.

(7) Maintain a close working relationship with the topo survey platoon leader or survey technician, the survey officers of corps artillery units, and the div arty survey officers. This coordination will ensure timely three-way flow of information concerning survey operations and data collection. It will also enhance timely completion of the survey mission.

c. Div Arty Survey Officer. The div arty survey officer is the survey platoon leader of div arty HHB. As such, he initiates tactical survey planning. He is responsible to the div arty commander for the execution of the survey plan to establish common survey control (the common grid) throughout the division area. He coordinates all artillery survey operations in the division to ensure effectiveness and to reduce duplication of effort. This includes the activities of the div arty SPCE, which is vital to the coordination of the survey effort. The div arty survey officer requests external survey support as required. He plans the employment of all organic fourth-order sections in the division. His plan is in accordance with the commander's guidance as interpreted by the S3. The locations of division tie-in points must be coordinated with adjacent div arty survey officers for establishment of a corps common grid. As the coordinator of div arty survey resources, the survey officer must advise the commander and staff on all matters pertaining to the following:

- Ž Survey requirements.
- Ž Techniques.
- Ž Capabilities.
- Ž Problem areas.

d. Div Arty Chief Surveyor. The div arty chief surveyor is the technical expert on surveying in the div arty. His primary duty is to advise the div arty survey officer. He must have wide experience in the employment of FA surveyors in support of all systems requiring survey data. He must—

- Ž Be prepared to assume the duties of the survey officer.
- Ž Brief the staff on survey and recon matters.
- Ž Formulate, implement, and supervise the execution of the survey plan.
- Ž Train surveyors in proper survey procedures.

He works closely with the TAB and battalion chief surveyors to ensure complete understanding of the div arty survey concept. He also supervises the div arty SPCE to ensure effective collection, evaluation, and dissemination of survey data.

e. TAB Survey Officer. The TAB survey officer is primarily concerned with extending survey control to organic TA assets requiring survey control. He receives a survey order from div arty survey officer and plans the employment of his section to accomplish the mission. The TAB survey officer must be ready to assume the duties of the div arty survey officer when directed. In coordinating the div arty survey effort, the TAB survey section may be assigned responsibility for other installations (for example, battalion SCPs) and may also assume SPCE functions.

f. TAB Chief Surveyor. In planning the TAB survey, the chief surveyor must work closely with other section leaders of the TAB in determining the locations of the required positions. Since the TAB will be required to help establish the common grid, the TAB chief surveyor must have a thorough knowledge of the div arty plan and be prepared to help in its implementation.

g. Battalion RSO. The battalion RSO is responsible for placing organic and attached firing TA elements on a common grid. His first priority is to establish common directional control. Other priorities are listed in the commander's guidance or are derived by the S3. The RSO coordinates the placement of the battalion SCPs with the div arty survey officer. He also coordinates with the RSO of any R artillery unit to ensure that units are on a common grid. The use of a common grid allows accurate transfer of target data between units. When required, the RSO and his HQ element (chief surveyor and driver) combine with the survey section to speed up operations such as setting up reflectors and computing data. The battalion RSO performs reconnaissance for the battalion to include selection of routes and evaluation of positions within the position area. He works with the S2 and S3 to determine areas requiring reconnaissance and helps the battalion commander in his reconnaissance. The RSO, as the technical advisor for survey in the battalion must monitor an effective hasty survey training program. The ability of the firing units to provide themselves with some form of survey greatly improves their effectiveness and allows the commander to mass fires of his subordinate units sooner.

h. Battalion Chief Surveyor. Responsibilities of the battalion chief surveyor parallel those of the div arty and TAB chief surveyors. He must advise and perform technical planning and coordinate the work of the survey team. He must be prepared to perform the duties of the battalion RSO and advise the battalion staff on survey and recon matters.

15-3. ESSENTIALS OF A GOOD SURVEY PLAN

In formulating the survey plan, the survey planner must remember and strive to meet certain essentials. The survey plan must meet the essentials discussed below.

a. Provide Required Control. The plan must provide survey control within the required accuracy to all installations that require survey.

b. Provide for Checks. Whenever possible, the plan must provide for checks; for example, closed surveys and alternate bases. Each member of the survey team continuously makes checks as a matter of standard practice.

c. Be Simple. The plan must be understood by all survey personnel. Work that is unnecessary or that exceeds the required accuracy must be avoided.

d. Be Timely. The plan must be capable of execution in the time allotted.

e. Be Flexible. The plan must be capable of being changed if the situation warrants.

f. Be Adaptable. The plan must be adaptable to the following:

- Ž Terrain.
- Ž Situation.
- Ž Personnel available.
- Ž Weather.
- Ž Equipment.

15-4. FACTORS AFFECTING SURVEY PLANNING

In formulating the plans by which the survey mission is to be accomplished, the survey planner must consider the factors of mission, enemy, terrain and weather, troops and time available (METT-T). The factors of METT-T cannot be considered independently because each is related to the other.

a. Mission. The tactical mission of the unit determines the time available, the area to be surveyed, the accuracy, and priority of the survey effort. It is the basis of the survey mission and determines the influence other factors have on the survey.

(1) Starting control. The location of existing survey control or the establishment of control by a higher echelon of survey affects the time required to extend control. Survey operations are concurrent at all echelons. When starting control is not available, the starting data must be assumed. **The** necessary survey operations are started immediately.

More extensive survey planning is required in areas where survey control is limited.

(2) Priority. The priority of work assigned is either listed in the mission or commander's guidance or derived from the mission by the S3. The priority of work affects the order in which the plan is executed or the type of survey performed.

(3) Number of installations. The number and locations of installations to be surveyed must be considered primarily with respect to time and troops available. The survey operations required to locate a few widely scattered installations often take more time and/or personnel than would be required for many closely grouped installations. In the survey plan, the survey tasks should be allocated so that the various survey teams complete their portion most expeditiously.

b. Enemy. The enemy situation has a strong influence on survey operations, since the disposition of troops may interfere with or restrict the movement of survey personnel and their equipment. Restrictions on communications, such as radio silence and enemy jamming, can greatly reduce the effectiveness of survey teams. The ability of the enemy to interfere with survey operations by denying use of terrain or routes is of prime importance. When survey operations are restricted, the commander should give priority of survey to those units supporting the main attack. FA surveyors must be able to implement suppressive fire immediately if they receive enemy fire. Terrain and cover must be used as much as possible. Unit SOP should provide for actions to be taken by survey teams that came under fire.

c. Terrain and Weather. The terrain and weather through which survey control must be extended are a primary factor in determining the methods of survey to be used. The survey planner must be so familiar with the effects of terrain and weather on survey operations that he can promptly and properly advise his commander on the time and personnel requirements. Adverse weather greatly reduces the capability of survey teams. Fog, rain, snow, heat or dust can reduce visibility to the extent that observation through an optical instrument is impossible. When visibility is poor, the commander may choose to put his survey effort on accurately locating his radar so that it can locate his firing units. In this case, the SIAGL would be used to establish common direction. Extreme heat or cold can also reduce survey team efficiency and increase the time needed to complete the survey.

d. Troops. The survey personnel and equipment available to perform the survey mission greatly affect the plan. The status of training determines the methods available and time required to perform survey. The availability and operability of survey equipment dictate the methods used in the plan.

e. Time. The time available to complete the survey operation is the most critical factor in planning. Survey planners must use the survey techniques necessary to provide the best survey data within the prescribed time. A trade-off between accuracy and time may have to be made, depending on the tactical situation. The commander makes the decision to allow decreased accuracy before the survey starts or to accept decreased accuracy on completion of the survey.

15-5. METHODS OF SURVEY

In addition to being able to evaluate the factors that will affect the survey, the survey planner must know the methods of survey that might be used and the advantages and disadvantages of each. The method chosen to provide survey control depends on the factors of METT-T. PADS survey supplemented by conventional methods is the primary means of executing the survey order.

a. PADS Surveys. The main advantage of the PADS over conventional methods is its speed. Disadvantages of the PADS include the following:

- Ž Reliance on the availability of survey control.
- Ž Mode and route of travel.
- Ž Restrictions on mission time and radial distance from the update point.

These are the main considerations in planning PADS operations. The time and distance factors used for planning PADS missions are shown in Table 15-2.

Table 15-2. Time and distance factors—PADS mission

Average speeds:	
-Cross-country	10 km per hour
-Unimproved road	25 km per hour
-Improved road	50 km per hour
Maximum speed	
(Improved road)	70 km per hour
Initialization	
(Including PMCS)	30 to 45 minutes
Mark coordinates	
of station	5 minutes
Two-position azimuth	10 minutes
Theodolite marks	10 minutes
Maximum mission time	
between updates	7 hours
Maximum radial distance	
from update point	55 km

EXAMPLES

Time computations for a div arty PADS mission requiring 80 km road travel to establish four battalion SCPs are as follows:

Initialization (45 minutes)	0.8 hour
Average travel time (80 km at 25 km per hour)	3.2 hours
Four bn SCPs x 10 minutes (40 minutes)	<u>0.7 hour</u>
Estimated mission time	4.7 hours
Time computations for a cannon battalion PADS mission requiring 40 km road travel to establish eight battery positions are as follows:	
Initialization (45 minutes)	0.8 hour
Average travel time (40 km at 25 km per hour)	1.6 hours
Eight battery positions x 10 minutes (80 minutes)	<u>1.4 hours</u>
Estimated mission time	3.8 hours

b. Conventional Survey Methods. Conventional methods of survey may be used-exclusively to extend or establish survey control if the PADS is not available. When the PADS is available, conventional methods are used to supplement PADS operations. Conventional teams provide update points for the PADS teams as required. This reduces the need to backtrack to close the PADS survey. Required installations along the route taken by conventional teams in establishing update points are surveyed to save time. Simultaneous observation is used to quickly establish direction before PADS teams arrive at installations. The conventional survey team gives the survey plainer flexibility. This allows the plan to be tailored to fit the factors of METT-T and allows sustained PADS operation by rotation of survey personnel. Conventional survey methods are as follows:

- Ž Traverse.
- Ž Triangulation.
- Ž Intersection.
- Ž Resection.

(1) *Traverse.* Traverse is the most suitable conventional method for most survey operations. It is a rapid and flexible means of extending control. Traverse does not require as much reconnaissance as triangulation and is extremely easy to control in the field. Traverse is ideally suited for survey in gently rolling or flat terrain or for extending control along roads and trails. For planning purposes, a well-trained traverse team can extend control over open and gently rolling or flat terrain at a rate of about 2 km per hour with the SEDME-MR or 1 km per hour with a 30-meter steel tape.

The use of offset legs to locate radar positions and other points can reduce the time required for the traverse. Offset traverse legs are not used to carry control, and an error made during the offset leg fieldwork will not affect traverse closure. Therefore, the fieldwork must be carefully checked.

(2) *Triangulation.* Triangulation is a means of extending control over long distances. It is ideally suited for survey in difficult terrain and for crossing obstacles. The primary disadvantage of triangulation is the amount of time required for reconnaissance. For planning purposes, triangulation requires about 30 minutes per station plus time for reconnaissance and travel between stations. Triangulation schemes are not as flexible as traverse schemes, since all stations in a triangle must be intervisible. Reconnaissance for triangulation generally requires as much time as the fieldwork, especially in extensive triangulation schemes. If the distance-measuring equipment is operational, traverse is preferred because it requires less time and fewer personnel.

(3) *Intersection.* Intersection is a method of triangulation in which only two angles in a triangle are measured. It is used to locate critical points, to establish update points for the PADS, and to survey firing and target-locating elements. When control is extended from a point established by intersection, the survey must be closed on another known point. The only exception to this is when intersection is used to locate 01 and 02 of the target area base.

(4) *Resection.* Resection is a method of obtaining control from distant points of known control that can be seen but not occupied. Resection is used to—

- Ž Locate firing and target-locating elements.
- Ž Establish update points for the PADS.
- Ž Locate 01 and 02 of the target area base.
- Ž Close a survey.
- Ž Check a location established by some other method of survey.

If a point located by resection is used to extend control, the survey must be closed on another known point. The only exception to this is when resection is used to locate 01 and 02 of the target area base.

15-6. STEPS IN SURVEY PLANNING

The steps in planning a survey are generally the same as the normal small-unit troop-leading steps. They are the procedures by which a commander issues instructions to his subordinates so that he can accomplish his mission. The lower the echelon, the more simple, direct, and rapid the process. Once the battle starts, orders and responses must be fast, effective, and simple. This requires teamwork.

Troop-leading steps should be an instructive and automatic way of thinking for section leaders and commanders. Without detailed instructions, commanders must turn a mission order into actions to support the plan of the next higher commander. Elaborate troop-leading procedures are useless if they slow the response of the force. The eight troop-leading steps are as follows:

- Ž Receive the mission.
- Ž Issue a warning order.
- Ž Make a tentative plan that will accomplish the mission.
- Ž Start the necessary movement.
- Ž Reconnoiter.
- Ž Complete the plan.
- Ž Issue the order.
- Ž Supervise.

Troop-leading steps are not rigid. They can be changed to fit the mission and the situation. Often, some steps are taken at the same time while others are considered continuously throughout the operation. When there is a lack of time, certain steps may be left out. The troop-leading steps as they apply to survey operations are discussed below.

a. Receive the Mission. Leaders receive a mission in either an oral or written OPORD or fragmentary order (FRAGO). Upon receiving the order, the leader analyzes the mission and plans the use of available time. The FSCOORD or S3 gives the survey officer a mission. It may consist of general areas to be surveyed or specific locations for battalion SCPs, platoon area SCPs, molar positions, and such.

b. Issue a Warning Order. The leader issues a warning order that gives his subordinates the mission and the time it starts. He issues it early enough for the section to plan and prepare. Normally, warning orders are issued through the chain of command. In that way, all personnel are kept informed of what they must do and why they must do it. The warning order should include the location of a nearby SCP or prominent landmark. Preoperation checks of vehicles and equipment are completed.

c. Make a Tentative Plan. The survey always connects required control with known control. The first step in formulating a survey plan is to gather information on the area, enemy situation, and any usable known control. A map reconnaissance is made to tentatively determine the methods of survey.

(1) *Gather information.* From the commander's briefing, the survey officer gathers vital information that influences the planning of his survey. This information should pertain to—

- Ž The situation to include the following:
 - Mission of the units.
 - Status of registration.
 - Time available.
 - Zones of fire.
 - Friendly positions.
- Ž Routes, communications, minefield, contaminated areas, and restrictions on modes of travel.
- Ž Support to R units, to allies, or to priority units.

(2) *Make map reconnaissance.* After attending the commander's briefing and issuing a warning order to alert his personnel, the survey officer, using any suitable map or map substitute, makes a thorough map reconnaissance. In doing this, he follows a specific procedure to ensure that full consideration is given to all factors. This procedure, in order, is discussed below.

(a) Map-spot installations. Known control and those installations requiring survey control are plotted on the map. Restricted areas and other information relative to the area of operations are also plotted.

(b) Select a tentative plan. All the factors that affect survey (METT-T) are fully considered, methods are chosen, and a tentative plan is made. Particular attention is placed on the accessibility of installations.

(c) Consider time. An estimate of the time required to execute the tentative plan is made. If the survey mission cannot be performed within the allotted time, the plan is modified or an appropriate recommendation is made to the commander. The planner may recommend the following

- Ž Extra personnel be made available.
- Ž Div arty support be requested.
- Ž More time be allowed for survey.
- Ž Location of certain installations be delayed.
- Ž Accuracy for certain installations be relaxed.

(d) Determine critical areas. Areas that require detailed ground reconnaissance are identified.

d. Start Necessary Movement. The survey planner must now make good use of the time available so that the section

will be in the area to be surveyed at the required time. If the section must move a long distance, it should start the move immediately on the basis of first rough plans.

e. Reconnoiter. After the map reconnaissance, the survey planner must make a ground reconnaissance as detailed as time permits. The tentative plan selected during the map study is changed as required by the terrain. Particular emphasis should be placed on critical areas. If necessary, indications are made to other survey planners or team chiefs at points where tentative plans may need revision or close coordination. A scale sketch of the survey is an easy way to summarize information determined from the ground reconnaissance. Since a PADS team can provide survey data as it reconnoiters, greater emphasis must be placed on efficiency of movement through the area.

f. Complete the Plan. Reconnaissance may not change the plan, but it certainly adds detail. The plan must be modified to fit all the information gained from the ground reconnaissance.

g. Issue the Order. A verbal survey order is issued, if possible, from a vantage point overlooking the area to be surveyed. The survey order follows the standard five-paragraph OPORD format. Continuing operations may require the use of a FRAGO.

h. Supervise. A leader must continually supervise the preparation for and execution of the mission. Constant supervision is as important as issuing the order. Along with supervising, the survey HQ element must help the conventional team as required. This help will supplement PADS operations and speed up the survey mission.

15-7. THE SURVEY ORDER

The survey order contains detailed instructions to each survey team not covered by local SOP. It gives general information needed for the efficient accomplishment of the survey mission. The survey order is written or issued orally. It generally follows the same sequence as the OPORD. Often, because of the tactical situation and wide dispersal of units, parts of this order may be issued by radio or wire or both.

a. The format for a five-paragraph survey order is shown in the example on page 15-12.

b. FRAGOs include the information in paragraphs 2 and 3 of the survey order and anything else that has changed since the last order.

EXAMPLE

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1. SITUATION

Items in this paragraph are addressed only if they have a bearing on the execution of the survey mission.

a. Enemy Forces. This subparagraph contains information from the S2 on enemy forces that may affect the survey mission.

b. Friendly Forces. This subparagraph contains information on higher, adjacent, and supporting units that may affect the survey mission.

c. Attachments and Detachments. This subparagraph lists sections attached or detached for a particular mission, such as an infantry squad for security.

2. MISSION

This paragraph is a clear, concise statement of the task to be done by the section. It includes those tasks specified by the S3. Also, it may include implied tasks determined by the survey officer from his mission analysis. Normally, it describes who, what, when, where, and as appropriate, why. This paragraph has no subparagraphs.

3. EXECUTION

a. Concept of Operation. This subparagraph briefly describes the survey methods to be used. It answers the question, Generally, how will the survey be done?

(The intermediate subparagraphs of paragraph 3 [b, c, d, e, and so forth] are specific missions of subordinate survey sections or teams. These missions tell the subordinate leader what he must do but not how he must do it [unless rigid centralized control must be maintained]. The mission of each subordinate team is addressed in its own paragraph, which contains instructions for that team only.)

f. Coordinating Instructions. The last subparagraph contains instructions common to two or more units. These instructions are designed to keep the subordinate units working together. Instructions such as primary methods of determining azimuths and distances are appropriate as coordinating instructions.

4. SERVICE SUPPORT

This paragraph lists those logistical considerations that may concern the surveyors. It lists food, ammunition, POL, location of corpsmen and aid stations, handling of enemy prisoners of war, and nonorganic transportation. These considerations are addressed only as they affect the particular survey. Local SOP items need not be addressed.

5. COMMAND AND SIGNAL

a. Command. This subparagraph gives the locations of the CP, survey officer, chief surveyor, and team chiefs.

EXAMPLE (CONTINUED)

b. Signal. This subparagraph lists nonstandard hand-and-arm signals, pyrotechnics, radio frequencies, call signs, and electronic counter-countermeasures (ECCM).

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15-8. PRINCIPLES OF A SURVEY SOP

a. An SOP standardizes procedures for those phases of operation the commander wants to make routine. These procedures are to be followed in the absence of specific instructions. The SOP of a battalion or higher-level HQ should contain a section on survey. The SOP for each level must conform to the SOP of the next higher level. Therefore, the survey portion of the SOP at each FA level should include only those survey procedures the commander wants to make standard throughout his command. Survey items the commander wishes to make standard only for the survey section of his HQ should be in the SOP for that particular section. A survey SOP does the following:

- Ž Simplifies the transmission of the survey plan.
- Ž Helps perfect the training of survey personnel.
- Ž Promotes teamwork through understanding.
- Ž Expedites survey operations.

(1) *Simplify the transmission of survey plans.* Instructions included in an SOP need not be restated in the survey plan. Many details on operations, measurements, or methods of survey may be outlined in the SOP. This eliminates the need for a lengthy and bulky survey plan or order. However, inclusion of instruction in the SOP does not prevent the survey officer from restating these instructions in the survey plan for emphasis.

(2) *Simplify and perfect the training of survey personnel.* Establishment of standard procedures for survey operations ensures uniform training and minimizes the need for special instructions. Through the continued use of standard procedures, survey personnel become more proficient in their operations.

(3) *Promote teamwork and understanding.* Standing operating procedures ensure uniform performance of survey operations and minimize the time and effort required for coordination. This is particularly true in those units that use more than one survey team.

(4) *Expedite survey operations.* When personnel become familiar with and use standard signals, techniques, and procedures, they will do their tasks in minimum time. Furthermore, the use of standard procedures reduces confusion and eliminates unnecessary survey operations.

b. To be effective, a survey SOP must be brief and must conform to established doctrine. If the SOP is too long and detailed, it loses its value as an instrument of ready reference. It must be flexible, since it cannot cover every possible survey situation or method. The SOP should give survey personnel enough latitude to adapt survey requirements to different situations rather than specify various types of problems that may or may not exist in the field. The SOP must conform to the doctrine and policy in the SOP of the higher HQ so that trained personnel reassigned from one unit to another will have no difficulty or be no less proficient. As a minimum, the SOP for survey operations should contain the information and instructions discussed below.

(1) *Principal duties of key personnel.* This survey SOP should define the principal duties of key personnel. The key personnel include the following:

- Ž Survey officer of the echelon at which the SOP is prepared.
- Ž Chief surveyor.
- Ž Survey team chiefs.
- Ž Team members.
- Ž Survey officers of subordinate commands, assigned or attached.

(2) *Acceptable methods of survey.* The survey SOP should include the methods of survey acceptable for various survey tasks. The methods will depend on the type of instruments available, time available, and status of training of survey personnel.

(3) *Specifications and techniques.* The survey SOP should contain specifications and techniques for fieldwork and computations. These include such items as the following:

- Ž Minimum closures for angles and triangles.
- Ž Manner of measuring angles.
- Ž Allowable errors.
- Ž Station marking techniques.
- Ž Recording techniques.
- Ž Required degrees of accuracy.

(4) *Supply and maintenance information.* The survey SOP should include pertinent information on supply procedures, stock levels, and maintenance responsibilities for all survey personnel.

(5) *Communications.* The survey SOP should include information pertaining to the use of radios, telephones, visual signals, and ECCM.

15-9. SURVEY PLANNER'S GUIDELINES

The guidance below is provided to help the survey planner prepare a survey plan. Use the guidelines to ensure that none of the important considerations are omitted.

a. Preparing the Survey Plan.

(1) *Enemy forces.*

- Ž Have all the intelligence data pertaining to the tactical situation been considered?
- Ž How will NBC hazards affect survey operations?

(2) *Friendly forces.* Have all the friendly forces in the area of operation been identified, and can they provide logistical support if needed?

(3) *Attachments and detachments.* Are reinforcing units needing survey control in the area of operations?

(4) *Number of installations.*

- Ž Have all elements requiring survey control been identified?
- Ž Which installations can provide their own survey control?
- Ž Are there survey requirements from the higher echelon?

(5) *Priority of installations.*

- Ž What priorities must be established to support the commander's guidance and the maneuver forces?
- Ž What method of survey should be used to meet the priority requirements?

(6) *Accuracy requirements.*

- Ž Can the accuracy requirements be met with the equipment available?
- Ž Where can accuracy requirements be relaxed until accurate data are available?
- Ž Does the plan Provide for common control throughout?

(7) *Time requirements.*

- Ž Can time requirements be met on the basis of time available, accuracies required, and survey assets available?
- Ž Is additional survey support required, and where is it available?

Ž Does the plan incorporate time lines that consider response time for units or systems to meet the operational times in support of the attack?

(8) *Coordination requirements.*

Ž Where is the SPCE located?

Ž What survey control is available?

Ž Are trig lists available?

Ž What maps are required?

Ž At what locations is control from higher or lower echelon required?

(9) *Assets (equipment and/or personnel).*

Ž Is all survey equipment operational?

Ž Are all survey personnel available?

Ž Can survey equipment be effectively used in existing terrain and weather?

Ž Does the survey plan provide for continuous operations?

Ž Does the response time require the survey HQ element to help the conventional team with survey fieldwork?

(10) *Alternatives to the survey plan.* Is the survey plan flexible enough to support maneuver forces under changing situations?

(11) *Command and control.*

Ž Is the command and control portion of the survey plan adequate?

Ž Does the survey plan allow for alternate communications during intense jamming?

(12) *Supply and logistics.*

Ž Does the survey section have enough rations for the first 72 hours of operation?

Ž Does the survey section have enough expendable supplies (such as hubs, stakes, and batteries) for the number of positions required?

Ž Do survey operations have to be interrupted for refueling vehicles, or can the survey vehicles be resupplied on the move?

Ž Where are DS maintenance units located for repair or exchange of equipment?

Ž Does DS maintenance have PADS units or line replaceable parts available?

Ž Are helicopters available to help the survey effort if needed?

Ž Does the survey section have its basic load of ammunition?

(13) *Allied requirements.*

Ž Does the plan include allied forces?

Ž Is survey support required for any allied units operating in the-of operations?

Ž What are the survey requirements for the allied units or systems?

b. *Executing the Survey Plan.*

(1) Disseminate trig lists, maps, and other pertinent survey information.

(2) Ensure that survey control is provided—

Ž To prescribed accuracies.

Ž On time.

Ž When needed.

(3) Ensure priorities are met.

(4) Maintain the goal of common control with the higher echelon.

(5) Maintain continuous communications with all echelons.

(6) Be prepared to modify the survey plan and execute changes rapidly.

(7) Inform the commander of the following:

Ž Delay in providing survey control and actions to be taken to correct this deficiency.

Ž Degraded accuracy caused by lack of time.

Ž Projected time when survey data will be upgraded.

Ž Any deviation from previous guidance.